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Appln. No.: 10/782,097
Amendment Dated April 26, 2007
Reply to Office Action of March 21, 2007

MAT-8510US

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A digital signal transceiver comprising:

a frequency modulator for outputting a modulated signal in a transmitting mode, and for outputting a non-modulated signal in a receiving mode, said frequency modulator comprising:

a variable frequency oscillator and

a first frequency divider unit that switches between a modulating frequency divider and a non-modulating frequency divider, the non-modulating frequency divider receiving the a signal output from the variable frequency oscillator and outputting a non-modulated signal, and the modulating frequency divider receiving the signal output from the variable frequency oscillator and a modulating signal and outputting the modulated signal;

a power amplifier for receiving the modulated signal output from the frequency modulator;

an antenna terminal arranged to be connected to an antenna;

an antenna switch comprising

a first branch port for receiving a signal output from the power amplifier,

a common port connected to the antenna terminal, said common port being connected to the first branch port in the transmitting mode, and

a second branch port connected to the common port in the receiving mode;

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a filter having an input port thereof connected to the second branch port of the antenna switch;

a high-frequency amplifier having an input port thereof connected to an output port of the filter; and

a mixer for mixing a signal output from the high-frequency amplifier with the signal output from the frequency modulator to output a signal including the signal from the high-frequency amplifier and the signal from the frequency modulator.

2. (Previously Presented) The digital signal transceiver according to claim 15, wherein the level of the phase noise in the modulated signal is larger than the level of the phase noise in the non-modulated signal.

3. (Previously Presented) The digital signal transceiver according to claim 1,

wherein the signal output from the variable frequency oscillator has a frequency varying according to a signal input thereto, and

wherein the frequency modulator further comprises

a reference signal generating unit for generating a first reference signal,

a phase comparator for comparing a signal output from the first frequency divider unit with the first reference signal in phase, and

a low-pass filter having an input port thereof connected to an output port of the phase comparator, said low-pass filter outputting the signal input to the variable-frequency oscillator.

4. (Previously Presented) The digital signal transceiver according to claim 3, wherein a frequency of the first reference signal in the transmitting mode is higher than a frequency of the first reference signal in the receiving mode.

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5. (Previously Presented) The digital signal transceiver according to claim 3, wherein the reference-signal generating unit comprises

a reference signal generator for generating a second reference signal, and

a second frequency divider unit for outputting the first reference signal by frequency-dividing the second signal by a first dividing rate in the receiving mode, and by frequency-dividing the high-frequency signal by a second dividing rate larger than the first dividing rate in the transmitting mode.

6. (Original) The digital signal transceiver according to claim 3,

wherein the variable frequency oscillator comprises a voltage-controlled oscillator for outputting a signal having a frequency varying according to a voltage input thereto, and

wherein the frequency modulator further comprises a charge pump for receiving the signal output from the phase comparator and for supplying a first current to the low-pass filter in the transmitting mode and a second current larger than the first current in the receiving mode to the low-pass filter according to the signal output from the phase comparator.

7. (Original) The digital signal transceiver according to claim 3, wherein the low-pass filter has a cut off frequency in the transmitting mode higher than a cut-off frequency in the receiving mode.

8. (Currently Amended) A digital signal transceiver comprising:

a frequency modulator for outputting a modulated signal in a transmitting mode, and for outputting a non-modulated signal in a receiving mode, said frequency modulator comprising:

a reference signal generating unit for generating a first reference signal having a frequency in the transmitting mode lower than a frequency in the receiving mode,

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a variable-frequency oscillator for outputting a signal having a frequency varying according to a signal input thereto,

a first frequency divider unit that switches between a modulating frequency divider and a non-modulating frequency divider, the non-modulating frequency divider receiving a signal output from the variable frequency oscillator and outputting a non-modulated signal, and the modulating frequency divider receiving the signal output from the variable frequency oscillator and a modulating signal and outputting a modulated signal,

a phase comparator for comparing one of the modulated signal or the non-modulated signal output from the first frequency divider unit with the first reference signal in phase, and

a low-pass filter having an input port thereof connected to an output port of the phase comparator, said low-pass filter outputting the signal input to the variable-frequency oscillator;

a power amplifier for receiving a signal output from the frequency modulator;

an antenna terminal arranged to be connected to an antenna;

an antenna switch including

a first branch port for receiving a signal output from the power amplifier,

a common port connected to the antenna terminal, the common port being connected to the first branch port in the transmitting mode, and

a second branch port connected to the common port in the receiving mode;

a filter having an input port thereof connected to the second branch port of the antenna switch;

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a high-frequency amplifier having an input port thereof connected to an output port of the filter; and

a mixer for mixing a signal output from the high-frequency amplifier with the signal output from the frequency modulator to output a signal including the signal from the high-frequency amplifier and the signal from the frequency modulator.

9. (Original) The digital signal transceiver according to claim 8, wherein the reference signal generating unit comprises

a reference signal generator for generating a second reference signal, and

a second frequency divider for outputting the first reference signal by frequency-dividing the second reference by a first dividing rate in the receiving mode, and by frequency-dividing the high-frequency signal by a second dividing rate larger than the first dividing rate in the transmitting mode.

10. (Original) The digital signal transceiver according to claim 8,

wherein the variable frequency oscillator comprises a voltage-controlled oscillator for outputting a signal having a frequency varying according to a voltage input thereto, and

wherein the frequency modulator further comprises a charge pump for receiving the signal output from the phase comparator and for supplying a first current to the low-pass filter in the transmitting mode and a second current larger than the first current according to the signal output from the phase comparator.

11. (Original) The digital signal transceiver according to claim 8, wherein the low-pass filter has a cut off frequency in the transmitting mode higher than a cut-off frequency in the receiving mode.

12. (Previously Presented) A digital signal transmitting and receiving apparatus comprising:

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a frequency modulator for outputting a modulated signal in a transmitting mode, and for outputting a non-modulated signal in a receiving mode, the frequency modulator comprising:

a reference signal generating unit for generating a reference signal,

a voltage-controlled oscillator for outputting one of the modulated signal or the non-modulated signal having a frequency varying according to a voltage input thereto,

a frequency divider unit that switches between a modulating frequency divider and a non-modulating frequency divider, the non-modulating frequency divider receiving a signal output from the voltage-controlled oscillator and outputting a non-modulated signal, and the modulating frequency divider receiving the signal output from the voltage-controlled oscillator and a modulating signal and outputting the modulated signal,

a phase comparator for comparing one of the modulated signal or the non-modulated signal output from the frequency divider unit with the reference signal in phase,

a charge pump for receiving the signal output from the phase comparator and for outputting a first current in the transmitting mode and a second current in the receiving mode according to the signal output from the phase comparator,

a low-pass filter receiving the first and second currents and outputting the signal input to the voltage-controlled oscillator,

a power amplifier for receiving an output signal from the frequency modulator;

an antenna terminal arranged to be connected to an antenna;

an antenna switch comprising

a first branch port for receiving a signal output from the power amplifier,

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a common port connected to the antenna terminal, the common port being connected to the first branch port in the transmitting mode, and

a second branch port connected to the common port in the receiving mode;

a filter having an input port thereof to the second branch port of the antenna switch;

a high-frequency amplifier having an input port thereof to an output port of the filter;
and

a mixer for mixing a signal output from the high-frequency amplifier with the signal output from the frequency modulator to output a signal including the signal from the high-frequency amplifier and the signal from the frequency modulator.

13. (Previously Presented) The digital signal transmitting and receiving apparatus according to claim 12, wherein the low-pass filter has a cut off frequency in the transmitting mode higher than a cut-off frequency in the receiving mode.

14. (Currently Amended) A digital signal transmitting and receiving apparatus comprising:

a frequency modulator for outputting a modulated signal in a transmitting mode, and for outputting a non-modulated signal in a receiving mode, the frequency modulator comprising:

a reference signal generating unit for generating a reference signal,

a variable-frequency oscillator for outputting a signal having a frequency varying according to a signal input thereto,

a frequency divider unit that switches between a modulating frequency divider and a non-modulating frequency divider, the non-modulating frequency divider receiving a signal output from the variable frequency oscillator and outputting the non-modulated signal, and the

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modulating frequency divider receiving the signal output from the variable frequency oscillator and a modulating signal and outputting the modulated signal,

a phase comparator for comparing one of the modulated signal or the non-modulated signal output from the first frequency divider unit with the reference signal in phase, and

a low-pass filter having an input port thereof connected to an output port of the phase comparator, said low-pass filter outputting the signal input to the variable-frequency oscillator, the low-pass filter having a cut off frequency in the transmitting mode higher than a cut-off frequency in the receiving mode;

a power amplifier for receiving a signal output from the frequency modulator;

an antenna terminal arranged to be connected to an antenna;

an antenna switch comprising

a first branch port for receiving a signal output from the power amplifier,

a common port connected to the antenna terminal, the common port being connected to the first branch port in the transmitting mode, and

a second branch port connected to the common port in the receiving mode;

a filter having an input port thereof connected to the second branch port of the antenna switch;

a high-frequency amplifier having an input port thereof connected to an output port of the filter; and

a mixer for mixing a signal output from the high-frequency amplifier with the signal output from the frequency modulator to output a signal including the signal from the high-frequency amplifier and the signal from the frequency modulator.

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15. (Previously Presented) The digital signal transceiver according to claim 1, wherein a phase noise in the non-modulated signal has a level different from a level of a phase noise in the modulated signal.